



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/910,583	07/20/2001	Kevin Mukai	5047	1386

32588 7590 04/24/2007
APPLIED MATERIALS, INC.
P. O. BOX 450A
SANTA CLARA, CA 95052

EXAMINER

TUROC, DAVID P

ART UNIT	PAPER NUMBER
----------	--------------

1762

SHORTENED STATUTORY PERIOD OF RESPONSE	MAIL DATE	DELIVERY MODE
3 MONTHS	04/24/2007	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

If NO period for reply is specified above, the maximum statutory period will apply and will expire 6 MONTHS from the mailing date of this communication.

Office Action Summary	Application No. 09/910,583	Applicant(s) MUKAI ET AL.	
	Examiner David Turocy	Art Unit 1762	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 2/21/07.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 14-19 and 23-32 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 14-19 and 23-32 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date <u>2/21/07</u> . | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 2/21/2007 has been entered.

Response to Amendment

2. Applicant's amendments, filed 2/21/2007, have been fully considered and reviewed by the examiner. The examiner notes the amendment to claims 14 and 18 and the addition of new claims 24-32. Claims 14-19, 23-32 remain pending in the instant application.

Information Disclosure Statement

3. The information disclosure statement (IDS) submitted on 2/21/2007 was considered by the examiner. The submission is in compliance with the provisions of 37 CFR 1.97. Accordingly, the information disclosure statement is being considered by the examiner. The examiner has attached the original copies of the IDS's for the applicants record.

Response to Arguments

4. Applicant's arguments filed 4/26/06 have been fully considered but they are not persuasive.

The applicant has argued against the EP 403 reference, stating the reference discloses stabilizing the gas mixture ratio before introducing the gas and therefore fails to disclose stabilizing individual flows. The examiner respectfully disagrees. While EP 403 may disclose stabilizing the gas mixture ratio, such a disclosure suggests that the gases are individually stabilized. To stabilize the ratio of the gases in a mixture, each of the gases in the mixture must each individually be stable. If one of the gases in a mixture is not stable then the entire mixture will not be stable. Therefore by stabilizing a gas comprising all the components, then each gas is individually stabilized. At the very least, to stabilize the ratio of a mixture, it would have been obvious to one of skilled in the art to stabilize each gas flow individually to achieve the desired result of stabilizing the ratio of the gases.

The applicant has argued against the KR 915 reference, stating that the reference discloses preventing the etching of the silicon nitride film and therefore can not reasonably be interpreted to selecting a time for injecting boron gas for a time selected relative to the desired nitride layer consumption during a subsequent anneal. This argument is not persuasive. First the examiner notes that the prevention of etching of the silicon nitride is due to the etching of the silicon nitride by phosphoric acid, which is produced from the BPSG deposition and the phosphoric acid fails to etch BSG (see page 6 of translation). Secondly, the examiner maintains that the process of KR 915 in view of EP 348 discloses forming a film comprising BPSG on BSG on silicon nitride.

Art Unit: 1762

The BSG layer of KR 915 in view of EP 348 has a similar thickness as the BSG layer taught by the applicant, see paragraph 0056. Therefore, the prior art and the present claims teach all the same process steps and thus the results obtained by applicants process must necessarily be the same as those obtained by the prior art. Therefore by annealing BSG and BPSG on a nitride, it must necessarily result in the same results as the applicant. Either 1) the applicant and the prior art have different definitions annealing, or 2) the applicant is using other process steps or parameters that are not shown in the claims. Thus it is the examiners position that the time selection is relative to the nitride consumption as required by the claim.

The examiner notes the applicant appears to be claiming selection of deposition conditions based upon a desired outcome, however, as discussed in the rejection to follow, the process of KR 915 in view of EP 348 discloses the same or substantially similar deposition conditions and process steps. Therefore if the claimed process is obtaining the result or reduced nitride consumption during anneal and prevention of reaction of the nitride with phosphorous, it is the examiners position that the process as taught by KR 915 in view of EP 348 must necessarily result in the same results.

Claim Rejections - 35 USC § 103

5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Art Unit: 1762

6. Claims 18, 19, 23-32 are rejected under 35 U.S.C. 103(a) as being unpatentable over KR 2001055915 (KR 915) in view of EP 843348 (EP 348).

KR 915 discloses a method comprising providing a substrate having a silicon nitride layer, depositing a BSG film of 10-150 Angstroms thickness thereon by flowing source gases, depositing a film of BPSG on the BSG layer, and then flowing hydrogen and oxygen over the structure at a temperature of 800-900 °C for 10-60 seconds (Derwent abstract). As the BSG layer has thicknesses in the claimed range, it will inherently prevent reaction of phosphorus with the nitride layer.

KR 915 does not explicitly disclose that the substrate is provided in a reaction chamber, or that silicon, oxygen, and boron sources are provided into the chamber to form the BSG layer, or that silicon, oxygen, boron, and phosphorus sources are provided into the chamber to form the BPSG film.

However, because EP 348 discloses that providing a substrate in a reaction chamber, providing silicon, oxygen, and boron sources into the chamber is effective for forming a BSG layer on the substrate and flowing silicon, oxygen, boron, and phosphorus sources into the chamber is effective for forming a BPSG layer on the substrate (page 29, line 24-page 31, line 20), it would have been obvious to have deposited the BSG and BPSG layers in this manner with a reasonable expectation of these steps being suitable for forming these layers.

KR 915 in view of EP 348 fails to explicitly disclose the predetermined period of time selected relative to the desired nitride layer consumption during a subsequent anneal. However, EP 348 discloses annealing the doped silicate layers after deposition to reflow, planarization of the deposited film, and assisting in gap-fill. Therefore it would

have been obvious to one of ordinary skill in the art to anneal the layers in the process of KR 915 in view of EP 348 to reap the benefits of reflowing to planarization of the deposited film and assist in gap-fill.

As to claims requiring an amount of time for which phosphorus source is not introduced in the chamber, this clearly depends on the desired thickness of the BSG layer, deposition rate etc. (see EP 348 at page 30, lines 17-20), therefore, it would have been obvious to have adjusted the amount of time phosphorus source introduction is delayed to values in the claimed range so as to achieve the desired BSG thickness prior to forming the BPSG film. The process of KR 915 in view of EP 348 discloses forming a film comprising BPSG on BSG on silicon nitride. The BSG layer of KR 915 in view of EP 348 has a similar thickness as the BSG layer taught by the applicant, see paragraph 0056. Therefore, the prior art and the present claims teach all the same process steps and thus the results obtained by applicants process must necessarily be the same as those obtained by the prior art. Therefore by annealing BSG and BPSG on a nitride, it must necessarily result in consumption of the underlying nitride layer. Either 1) the applicant and the prior art have different definitions annealing, or 2) the applicant is using other process steps or parameters that are not shown in the claims. Thus it is the examiners position that the time selection is relative to the nitride consumption as required by the claim.

As to claim 23: The applicants specification discloses such nitride consumption occurs at 10 second delay prior to introducing phosphorous and therefore it is the examiners position as stated above that it would have been obvious to one of ordinary skill in the art to have adjusted the amount of time the amount of time phosphorus

Art Unit: 1762

source introduction is delayed to values in the claimed range so as to achieve the desired BSG thickness prior to forming the BPSG film.

As to the claims directed to thicknesses, flow rates, deposition rates and weight percentage of Boron and phosphorous, the process of KR 915 in view of EP 348 discloses forming a film comprising BPSG on BSG on silicon nitride. Additionally, EP 348 discloses depositing supplying the gases at substantially similar flow rates, deposition rates, and weight percentage of boron and phosphorous as claimed (pages 29-31). For example, EP 348 discloses a BPSG deposition rate of 3500-5500 Angstroms per minute (Claim 27), TEPO flow rate at 10-100 mgm (claim 26), and a BPSG film comprising boron at 2-6 wt% and phosphorous at 2-9 wt% (Claims 31 and 32), each of the proceeding within the range as claimed by the applicant. Additionally, KR 915 discloses forming g a BPSG film of 9500 angstroms (page 5), which is within the range as claimed in claim 25. Therefore by deposition BSG and BPSG on a nitride using the same process parameters, it must necessarily result results obtained by the applicant. Either 1) the applicant and the prior art have different definitions reactions, or 2) the applicant is using other process steps or parameters that are not shown in the claims. Thus it is the examiners position that the thickness and deposition conditions selection is relative to prevent reaction of phosphorus with the nitride layer.

7. Claims 14-17 rejected under 35 U.S.C. 103(a) as being unpatentable over KR 915 in view of EP 348 as applied above, and further in view of EP 1139403 (EP 403).

The above applied art does not explicitly disclose delaying introduction of the source gases into the chamber until their flows stabilize. However, because EP 403

Art Unit: 1762

discloses that allowing the source gases to bypass the chamber until their flows stabilize when depositing doped silicon oxide films such as BPSG prevents higher dopant concentrations in the first few nanometers of the film and provides a homogenous dopant concentration in the film (0005-0009), it would have been obvious to delay introduction of the source gases to the chamber until their flows stabilize so as to achieve a homogenous dopant concentration in the film. To stabilize the ratio of the gases in a mixture, each of the gases in the mixture must each individually be stable. If one of the gases in a mixture is not stable then the entire mixture will not be stable. One of ordinary skill in the art would appreciate that there are only two ways of stabilizing a gas mixture, by stabilizing the entire mixture or by stabilizing each gas prior to mixing. Therefore to stabilize the ratio of a mixture, it would have been obvious to one of skilled in the art to stabilize each gas flow individually with a reasonable expectation of success to achieve the desired result of stabilizing the ratio of the gases.

Conclusion

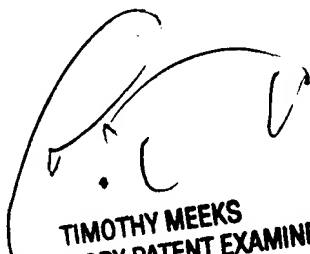
8. Any inquiry concerning this communication or earlier communications from the examiner should be directed to David Turocy whose telephone number is (571) 272-2940. The examiner can normally be reached on Monday-Friday 8:30-6:00, No 2nd Friday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Timothy Meeks can be reached on (571) 272-1423. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Art Unit: 1762

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

David Turocy
AU 1762



TIMOTHY MEEKS
SUPERVISORY PATENT EXAMINER